Short timescales of high-silica rhyolite generation in the Mono-Inyo Craters indicated by U-Th isotopic disequilibrium

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Uranium and Th isotope measurements for some of the youngest basaltic- to rhyolitic lava flows associated with the Long Valley caldera and Mono-Inyo Craters indicate that the lavas have pronounced U and Th isotopic disequilibrium. The ($^{238}U/^{232}Th$) ratios range from 0.69 to 1.23, and the ($^{232}Th/^{230}Th$) ratios range from 0.80 to 1.03. The majority of the lavas plot to the right of the equiline, which corresponds with a subduction zone influence on the U and Th isotope compositions. A basaltic inclusion from the Mono Inyo dacite (age = 18 Ka, epsilon-Nd = +2) is one of the samples farthest to the right of the equiline, which indicates that the basaltic magmatism associated with the formation of the silicic magma system is subduction-like. In contrast, an older (ca. 100 Ka) trachybasalt lava from the Long Valley north moat (epsilon-Nd= -3) plots to left of the equiline. We interpret these differences as reflecting lithospheric sources for the small-volume alkalic lavas and asthenospheric (subduction-affected) sources for the larger volume silicic system. The preservation of strong U-Th isotopic disequilibrium in high-silica lavas clearly indicates that the rhyolites do not have long magma chamber residence times as has been inferred for other silicic systems in western North America. This observation is in accord with the young age of the Mono Craters (less than about 18 Ka) and suggests that this system has not yet stored up a large amount of silicic magma that could feed an eruption of Bishop Tuff size.